



Using machine translator as a pedagogical resource in English for specific purposes courses in the academic context

O uso do tradutor automático como recurso pedagógico na aula de inglês para propósitos específicos no contexto acadêmico

Débora Borsatti

Universidade de Santa Cruz do Sul (UNISC), Santa Cruz do Sul, Rio Grande do Sul / Brasil

deborsatti@gmail.com

<http://orcid.org/0000-0003-1486-0047>

Adriana Blanco Riess

Universidade de Santa Cruz do Sul (UNISC), Santa Cruz do Sul, Rio Grande do Sul / Brasil

adrianariess@unisc.br

<http://orcid.org/0000-0002-0228-6028>

Abstract: This paper presents a proposal for pedagogical use of MT in English for Specific Purpose (ESP) courses, aiming at investigating the efficiency of this technology as a support for reading scientific texts in English as a FL. The theoretical approach is on ESP, reading and comprehension and a proposal to use MT in ESP courses, aiming to understand the processing of MT and how this knowledge can raise benefits on reading comprehension for academic purposes. In addition, we discussed corpus linguistics and its relation to language teaching as well as its role in MT. The analysis shows that, due to the hybrid system that utilizes the rule-based system and the corpus-based system, Google Translate produces relatively understandable and readable texts. Despite its evident limitations, the tool can provide linguistic awareness when pedagogically explored by ESP teachers in academic context.

Keywords: Machine Translation; pedagogical tool; reading; English for Specific Purposes.

Resumo: Este artigo apresenta uma proposta de uso pedagógico de tradução pela Máquina (MT) em cursos de inglês para fins específicos (ESP), com o objetivo de investigar a eficiência dessa tecnologia como suporte para a leitura de textos científicos em inglês como L2/LE. A abordagem teórica é sobre ESP, leitura e compreensão e uma proposta de uso de MT em cursos de ESP, com o objetivo de entender o processamento da MT e como esse conhecimento pode trazer benefícios na compreensão da leitura para fins acadêmicos. Também, discute-se a linguística de corpus e sua relação tanto com o ensino de línguas quanto seu papel na MT. Por fim, a partir da análise que se faz, devido ao sistema híbrido que utiliza o sistema baseado em regras com o sistema baseado em corpus, o *Google Translate* produz textos relativamente compreensíveis e legíveis. Apesar de suas limitações evidentes, essa tecnologia pode fornecer consciência linguística quando explorada pedagogicamente pelos professores de ESP no contexto acadêmico

Palavras-chave: Tradutor Automático; ferramenta pedagógica; leitura; Inglês para Propósitos Específicos.

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Introduction

In Brazil, English for Specific Purpose (ESP) courses are commonly offered in Universities, and they are basically focused on reading skill practice. Recently, a number of Higher Education Institutions (henceforth HEI) in the country has been developing actions for internationalization, which aim to allow Brazilian universities to take part in the international academic community, and part of this process involves foreign language learning, specially English, which is considered a *Lingua Franca (lato sensu)* in the scientific context. One of the actions worth mentioning is the *International Mobility Program Science Without Borders* which aimed at developing science in Brazil by funding undergraduate and graduate members of the academic community to study in universities abroad. In fact, a discussion on internationalization and language policies in Brazil has already been published by Sarmento; Baumvol, Martinez (2019) on a special issue of the journal *Organon* by the Federal University of Rio Grande do Sul-URFGS.

Among the methods for teaching ESP in the academic environment in Brazil, developing reading strategies is the most frequent

one because it is considered a need for undergraduate students (CELANI *et al.*, 1988, 2005; RAMOS, 2009) and ESP focuses on the student's needs (BLOOR, 1997; HUTCHINSON; WATERS, 1987; ROBINSON, 1980, 1991). Reading comprehension is a complex task that involves various cognitive abilities and strategies and reading in a foreign language (FL) is even more complex and requires a certain level of proficiency to be accomplished. A beginner learner faces different linguistics barriers, such as language structure and most of all, lack of vocabulary knowledge.

Depending on the reading goal, skimming reading or knowing the general subject is enough, but if the purpose is studying and learning, for instance, is it necessary to go beyond the main ideas. Although the learner uses strategies such as focusing on cognate words and trying to infer the general meaning through previous knowledge, in order to have a deeper comprehension, at some point the reader will have to search for the meaning of words, which can be done by looking a word up at a dictionary, or even checking whole sentences by using an automatic online translator.

The Internet era has provided us with a wide range of easily accessible information on various subjects. Although the effectiveness of some online resources may be doubted from the educational perspective, the Internet is still one of the main sources for research and language learning. Using machine translation (MT), more specifically, Google translate, and having the information instantly translated instead of thinking and analyzing is a subject that might concern most language teachers. However, it is undeniable that most students resort to these tools when they are struggling with a meaning in a foreign language. In addition, what must be considered is that the contemporary world presupposes the use of technology and the internet has a major role in it.

There is a number of studies suggesting the use of MT in EF classes through different perspectives, such as the ones related to translation programs (LEWIS, 1997; MCCARTHY, 2004), comprehension and acceptance of translated texts (LEFFA, 1994; PETRARCA, 2002), the relationship between MT and English as a global language (CRIBB, 2000), techniques for detecting plagiarism and work produced by MT (LUTON, 2003), writing and post-editing via MT (NIÑO, 2004; KLIFFER, 2005), in addition to using MT as a reading strategy (RIESS, 2015; SCARAMUCCI, 1997).

This paper addresses the use of free online MT in ESP courses at universities in Brazil. For this purpose, previous investigations on the use of MT for FL teaching and learning are explored before discussing their implications for the language class along with some practical examples of using MT for language teaching for academic reading purposes. It is important to bear in mind that Machine translation is a resource for teaching grounded on a perspective defined by Larsen Freeman (2003) as *grammarian*, students do not learn by a set of rules, more than that they learn by doing grammar. In addition, using MT is only seen as feasible the moment technologies of information and communication have proved to offer advantages for teaching and learning. This is specially seen in the studies of Corpus linguistics (SARMENTO; TESSLER; BAUMVOL, 2019)¹ as well as Ergodic learning (LEFFA; BEVILÁQUA, 2019) where students count on resources that go beyond the didactic material because they stimulate both autonomy and learning styles.

In order to intertwine the objectives of teaching ESP and the advantages of using MT as a pedagogical support this paper is divided in three parts. The first one explores the area of English for Specific Purposes; it presents a brief overview on how the field was developed in Brazil up to the present times. The second part discusses Machine Translation and the conceptual foundations that support our belief it can be used to enhance learning. Finally, the third part describes the proposal itself on how MT is suitable for designing ESP lessons.

1 English for Specific Purposes

According to Hutchinson and Waters (1987) and Bloor (1997), the main issues related to ESP in teaching began in the 1960s, when the United States economy became dominant in the western world and English became an internationally accepted language in trade, business in general and in the academic context. Consequently, language learning needs began to have an important role to the design of language courses. Hutchinson and Waters (1987) defined ESP as a course in which “all the decisions as to content and method are based on the learner’s reason for learning.

¹ English as a Medium of Instruction into Practice. Oral Presentation. 27th Annual Conference of the Brazilian Association for International Education, Cuiabá, 2015.

The concept of ESP was explained by Robinson (1991) as “an enterprise involving education, training and practice and drawing upon three major realms of knowledge: language, pedagogy and the students’/ participants’ area of interest” (ROBINSON, 1991, p.1). The author cites some criteria for a course be considered as ESP, such as “goal directed”, meaning that the student needs the language for work or for studies; the relevance of precision in needs analysis; establishing course length; and student profile - normally adults or young adults who usually have some background knowledge of the language. Another relevant aspect about ESP courses is that they must be designed based on the students’ area of studies.

Methodological aspects of ESP were described by Dudley Evans and St. John (1998), who point that these courses normally take place in the working context or at university and the methodological choices may differ from General English courses, since the courses may be designed having a specific discipline in mind. Aiming at discussing the specificities of ESP in the Brazilian context the next sections present an overview of the area both in the first years of development and the current studies in progress.

1.1 A brief overview of ESP in Brazil

The origin of ESP courses in Brazil began with a project developed by a group of researchers from PUC-SP in the 1970’s (CELANI *et al.*, 1988; RAMOS, 2009). The project was initially under the coordination of the researchers from PUC-SP and involved most of the federal universities in Brazil. The focus of the studies was around the reading skill due to the results of the needs analysis which indicated that most university students at that time needed to read texts and books in English on their specific area of studies. This is the reason why ESP courses in Brazil are associated with the teaching and practicing of reading.

In Brazil, ESP is often related to instrumental reading, which comprises reading practice for comprehension and interpretation of texts. From the conception of reading as an active process, Farrell (2003) explains that, after establishing the focus of the class and selecting the texts (based on student needs), the next step is the teaching of reading fundamentally anchored in reading strategies. According to the author, the success of reading activity is directly related to the use of appropriate and effective strategies.

The process of internationalization of HEI has highlighted the importance of English as a global language. Hamp-Lyons (2011) points out that the role of EL has become increasingly stronger, which forces researchers to publish their studies in English. In addition, as stated by Hyland (2006) researchers find more reference to their studies when they are published in EL. One of the reasons ESP has been an area of interest in the Brazilian context is the importance of the country in an international scenario. It seems to be obvious that linguistic skills play a key role in this panorama where sociocultural, economical and political powers are at stake.

Along the late decades new approaches for ESP have been discussed by various researchers, such as Ramos (2004) who introduced the pedagogical importance of implementing genre in the EFL classroom. More recently, Sarmiento, Tessler, and Baumvol (2015) have discussed the idea of English as Medium of Instruction (EMI) related to internationalization in the Brazilian HEI and the need to introduce other skills into the ESP courses, such as speaking, listening and writing. This approach, which aims to assure that the student will be able to participate in international academic events, as well as being able to publish their paper in international journals, is called English for Academic Purposes (EAP) and it is currently offered in universities all over the world. However, there is a long way to go in the EAP field in Brazil, since it is a process that has just began to be discussed and analyzed in the country.

English for Academic Purposes (EAP) courses are similar to any other ESP courses, which are based on the student's needs. In this case, the need is related to academic interests, therefore, EAP is a course designed for teaching English to assist learners in target language studies or research (FLOWERDEW; PEACKOCK, 2001; JORDAN, 2012). Consequently, the content "currently focuses on seeking language specificities used in academia [...] incorporating and going beyond the communicative context" (HYLAND, 2006, p. 2).

In this paper, the term ESP was chosen due to the focus on reading skill, which is a reality in courses offered at different universities in Brazil, but it may be extended to other skills practice in the future. However, developing new methods of teaching English in the academic context is important given its relevance for science within the contemporary global scenery, and using machine translation (MT) is part of the globalized world. Therefore, including this tool in the ESP courses might give another perspective for EFL students in terms of reading comprehension.

1.2 The state of the art of ESP in Brazil

As explored in the previous section teachers and professors in Brazilian universities have already adopted ESP lessons. The first experiences have proved to be fruitful so as to enrich teaching with new methodologies and resources. The present section describes current studies that represent the state of the art of ESP in Brazil and point to the future of the area. In general terms, technology plays a key role in this development, either because of electronic corpora or because of MT itself.

It was already mentioned that there are many examples of universities in Brazil which have introduced English in the academic context. However, it is worth talking about some recent studies which can be considered “hands on” in terms of teaching. For instance, Maciel and Vergara (2019) discuss the role of English teaching in a Medical school; Sarmiento and Baumvol (2016) also investigate multilingual students learning through Integrated Language and Content Instruction (ILCI). Moreover, Kirsch (2019) analyzes how teachers of English were trained to perform in light of internationalization/globalization.

Basically, in all the work by the authors mentioned above the idea is centered in earlier fundamentals of teaching, specially the view of ESP teachers as also researchers. Dudley-Evans and St. John (1998) explain it is necessary to raise adequate textual information to design instruction and that needs assessment for creating and adapting didactic materials. In addition, there must be a further thought about developing reading strategies during ESP lessons. There are several types of strategies that can turn reading into an active process in a foreign language class; these strategies have long been investigated, such as the useful list seen in Anderson (1991) and Koda (2005), as well as the discussion about translation in Grabe (2009). The teacher who uses language learning strategies, according to Oxford (1990) is no longer at the center of teaching and becomes a facilitator, helping students to identify and use the appropriate strategies. It is undoubted for these authors that students become more autonomous in learning (or acquiring) a language when reading strategies are at stake.

In terms of teaching strategies, Coxhead (2000) suggest that in ESP students should be exposed to high frequency academic words, most of times gathered in ready-made lists such as *the academic word list online*. Regarding grammar, Larsen Freeman (2003) talks about a concept called *grammarians* from the perspective that grammar and vocabulary are

addressed as integrated with the 4 skills, rather than stand-alone issues. Consequently, grammar cannot be seen as a set of rules to be memorized, but as a phenomenon of *doing grammar*. As a whole, an updated ESP course has to consider the use of an academic English language corpora available online. In addition, it has to develop general academic skills and have teachers explaining all the existing learning styles, strategies, as well as make students be part of their learning process by discussing their preferences.

Examples of ESP courses are the ones described by Berber Sardinha (2006) that envisaged instructional material production using corpora. Moreover, Barbosa (2004) prepared units on a Foreign trade course at a distance founded on an experimental approach (KOHONEN, 2001). Leffa (2019) explains that language pedagogies must evolve from three perspectives: instructionism to constructivism and then to connectionism (HEICK, 2017; MATTAR, 2018). It all starts from linguistic exposition (linguistic corpora) and it moves to active learning, which demands the student to use accessible resources to learn. This sequence moves up to ergodic learning; this concept is grounded on the idea that the student not only builds his/her own learning according to the resources he/she uses, as well as he/she modifies the learning dimension.

While we can talk about the state of the art of ESP in Brazil today, it is not less important to discuss MT, once this is the center of this paper. It is not obvious, neither it is accepted at all ESP courses should allow students to use online translators, such as Google translate. The next section presents the area of Machine translation because it is believed that the limitations as well as the strengths of this tool enable instructional designers or teachers to take advantage of them for more accurate use.

2 Machine translation

If we are to investigate the introduction of MT in ESP classes we have to keep in mind that Foreign Language tutors do not necessarily need to know much about the working MT software, but they should know these tools are available, how to use them, and their general strengths and weaknesses. Therefore, it is important for this paper to present some of the basis of the systems for MT, because the teacher as a researcher may be limited by the performance of the tool. As it was stated previously in this study, MT may provide linguistic awareness as a source of knowledge much more efficiently once it is explored pedagogically.

The introduction of MT into language learning contexts has been compared to the advent of the calculator by some researchers (LUTON, 2003, p. 770; GROVES; MUNDT, 2015, p. 120). Nevertheless, “while there seems to be general agreement that children should learn to do basic arithmetic without a calculator before moving on to more advanced operations in which the calculator can be used as a shortcut, it is possible that the parallel to MT and language learning does not extend as far”. Therefore, many teachers seem to be resistant to using MT in class, which could compromise the way students think and develop language learning. What has to be reinforced is that linguistic skills and mathematics are different kinds of knowledge, for this reason it is not clear that a mere comparison between the two of them is a benefit.

One of the proposals of this study is to present teaching English in the university context and the role of the teacher as developing linguistic awareness, not only language itself. Tomitch (2009) explains that teaching reading in a foreign language is much more than teaching language itself. For this reason, it is believed that through the analysis of translation errors related to specific lexical items and syntactic structures, students will be able to understand how translation works as well as develop language awareness. We consider the lexicon brings information related to cultural differences, for example, that go beyond the language itself. Error analyses and language transfer are not new in the area of Second language Acquisition (henceforth SLA); however, they have a broader view here. In order to give a hint of what is meant in this proposal, the example that follows can clarify. Although students are not quite familiar with terms such as polysemy, lexical ambiguity, and structural ambiguity, examples in English using MT may illustrate that polysemy can create lexical ambiguity, and word order can determine the level of structural ambiguity in a sentence. An example could be seen in *We need to see that house* and *I will house the club in a new building*, in the first sentence the word *house* is a noun and in the second it is a verb; syntax in this sense differentiates the meaning. Students, then, are displayed with an obvious differentiation in meaning that translation can easily determine.

2.1 What MT is and how it works

According to the definition by Hutchins and Somers (1992), MT are “computer systems responsible for the production of translations from one natural language into another, with or without human assistance”

(HUTCHINS; SOMERS, 1992, p. 3). Hutchins (2003) explains that in fully automatic translation, the system translates the entire text without the intervention of the human translator, producing a raw translation, commonly known as ‘informative translation’.

MT systems can be programmed for two languages (bilingual systems) or for more languages (multilingual systems). In terms of processing, MT systems can be grouped into two categories: rule-based system and corpus/statistical-based systems. Rule-based systems work based on rules for/of morphology, syntax, lexical selection and rules transference. They operate by filtering source text input such as morphological analyzers, part-of-speech taggers and bilingual dictionaries and then they transfer rules and reorder them, whereas statistical MT systems are based on “machine-learning technologies” and rely on “large volumes of parallel human-translated texts from which the MT engine can learn” (STEDING, 2009, p. 184).

Rule-based systems contain three main approaches. The first is the direct approach which, according to Hutchins (2003) definition, operates as a large bilingual dictionary, in which the source text is translated word by word, not considering the analysis of its syntactic structures or relations between words in the sentence.

The second is the transfer approach, which is more widely used and comprises three phases: analysis, transfer and generation. Hutchins (2003) explains that transfer systems may have separate programs for lexical transfer (selection of equivalent words in vocabulary) and structural transfer (transformation of source language structures into appropriate target language structures), differently from the direct approach, the transfer approach takes structure/syntax into consideration.

Developed in the 1980s, interlingua is the third approach, which is based on the assumption that it is possible to convert target language (TL) texts into common syntactic-semantic representations in different languages. Interlingua is based on the principles of universal linguistics. Thus, translation occurs into two phases: from source language to interlingua and from interlingua to target language.

Corpus-based approach is more recent and can be divided into two categories: statistical-based MT and example-based MT. Somers (2003) explains that this model is based essentially on the alignment of words, expressions and word sequences in a parallel bilingual corpus as well as on probabilities calculus of words/expressions in a given

sentence to correspond to one or more words in the equivalent sentence in the target language.

The word “*língua*” in Portuguese can be used as an example of what was mentioned in the previous paragraph because it represents ambiguity meaning both language and tongue, which are different words in English. Using Google translate, when inserting the sentence: “*Eu morde minha língua*”, the result is “I bit my tongue”, but when the sentence is “*Eu não falo sua língua*”, the translation is “I don’t speak your language”. This means that the relation between the verb and noun is calculated through probability. The verb “*morder* (bite)” combined to “*língua* (tongue)” and the verb “*falar* (speak)” is combined to “*língua* (language)”. Somers (2003) ensures that it involves a great complex probability calculation.

Unlike the statistical-based system, example-based MT operates by comparing the input with a corpus of representative examples already translated, drawing the closest correspondences as a translation model for the target text. As Somers (1998) points out, this approach resembles the way human translators work, since it solves new problems based on solutions used for similar previous problems and this is why the translation outcome is more fluent and less literal.

Many MTs are actually hybrids, their basic design and main mode of operation put them in one of the two categories. Google Translate exemplifies the latter approach, as its website explains in the following terms: “By detecting patterns in documents that have already been translated by human translators, Google Translate can make intelligent guesses as to what an appropriate translation should be” (Google).

Bowken (2002) makes a connection between this approach and output quality, noticing that because statistical MT reflects a “better understanding of the strengths of machines” than earlier methods, errors are “less common and considerably less outrageous” than in the past (BOWKEN, 2002, p. 3).

2.2 Corpus linguistics and MT

One of the investigations that is also part of the theme “Machine translation” as a whole is *Corpus linguistic*, more specifically, *Electronic Corpora*. This is a branch of Computational linguistics that deals with the processing, storage and analyses of great amounts of linguistic data that

are machine readable. The Latin term *corpus* refers to a body because it is formed by a variety of relevant linguistic information which display both oral and written language behavior.

In this study that discusses the use of online *Google translate* it is implicit we are talking about electronic *corpora*, since information is changed into digits that are machine readable, as we stated before. A traditional *corpus* can be a collection of physical texts, for instance, the indigenous talk of some Amazon region annotated by ethnographic research. As for *Google translate* it utilizes all the written texts that were translated by humans and published on the web. For this reason, its database is giant, as such, it can extract linguistic items which are able to generate new translation in the target language.

It is also worth saying in the case of MT that Google corpora can be either Comparative or Parallel. They both approximate; however, comparative corpora contrast the linguistic items of each language, they deal with at least two languages (2 monolingual texts) that are contrasted. An example of this corpus is *Compara* seen at <http://portugues.mct.pt/COMPARA/>, it is made up of literary work in its original language by the side of its translation that was once published by a human translator. A slight difference to Parallel corpora is that there is a linguistic *corpus* in the first language and in parallel the engine displays encountered translations (MCENERY; XIAU; TONO, 2006). Basically, Google deals with parallel corpora, but as it will be studied next it actually uses a hybrid system.

In terms of language teaching, which is the focus of this article, parallel corpora have been much used to a diversity of pedagogical objectives. They can be used to teach technical vocabulary in ESP classes; Berber Sardinha (1998)² for example, presents the Business English corpus that is fruitful if the teacher needs a good source for instructional material. In addition, Riess e Gabriel (2019) analysed lexical disambiguation during reading in English as FL/L2 using the *Webcorp*, a linguistic corpus of general English. The authors investigated how a reader disambiguated the word *mind* in its different contexts of meaning.

In 2015 a special issue of the Brazilian journal *Domínios da linguagem* was published in which the editors focused on linguistic

² Size of a representative corpus. Summary of discussion on CORPORA email discussion list, 26 August 1998.

corpora, methods, and interfaces. In the presentation section they mention the development of this area in Brazil and present other journals which were also dedicated to related subjects, such as *Veredas* in the year of 2009 and *Revista Brasileira de Linguística Aplicada* (2011). Almost 10 years ago these journals already pointed Corpus Linguistic as a promising field to be explored by researchers of language.

What is also important to mention here refers to corpus linguistics and statistical language learning. In fact, an electronic translator such as Google needs to be fed with a great deal of data; however, it works on the basis of statistics. That means the more frequent the translation of a word or segment appears, the more it will be used next time. Charniak (1996) explains that the objective of statistics is to count how often the translation appears, so that the preferable translated word or segment becomes a prototype. Consequently, programming can calculate the probabilities of an occurrence.

2.3 MT as a teaching resource in ESP class

Incorporating technology in foreign language classroom without compromising students' practice is a challenge for teachers all over the world. The relevance of this subject is highlighted by Hall (2001) when he states that "How well we prepare learners of additional languages to meet the social, political, and economic challenges of the next several decades will depend partly on our success in integrating technology into the foreign language curriculum". Teaching students to evaluate these tools may provide them with a model for criticizing as well as reflecting on other technologies that work as pedagogical resources.

In fact, technology can offer excellent tools for language teachers and MT has been discussed as one of them. Different perspectives of studies have been conducted by researchers in various parts of the world. These works promote the use of MT in language teaching for distinct purposes, such as for developing critical thinking, promoting electronic Literacy and language awareness (CORREA, 2014; WILLIAMS, 2006) for correcting/editing grammar, training future professional translators (KLIFFER, 2005) and even for preventing plagiarism (STEDING, 2009). Post-editing is the most common practice, and it involves the correction of raw MT output into an acceptable text for a particular purpose (BELAM, 2002; LA TORRE, 1999; NIÑO, 2004).

A study conducted with FL students at Duke University in 2011 and 2012 evidenced the student's preference for Google Translate through the significant percentage of 81% that reported using it to support their language learning (CLIFFORD *et al.*, 2013, p. 111). This tool is described as a "free translation service that provides instant translations between dozens of different languages" (Google).

Ana Niño's (2009) survey about students' and professors' perceptions of MT has served as the basis for investigation at Duke, which addresses her observation that a survey of a broad spectrum of language students (not just advanced learners) would provide a more accurate picture of the state of MT use in the language classroom.

One of the first authors to research on the role of MT in language classes was Ball (1989). The author suggested the correction of errors presented in computer-produced translations as teaching application of MT for language students. Later, Somers (2003, p.327) stated that this practice could "bring out subtle aspects of language differences" as well as "reinforce learners' appreciation of both L1 and L2 grammar and style".

Other authors who recommend teaching practices using MT in FL contexts include McCarthy (2004), who wrote 12 "solutions" for dealing with the inevitability of MT use based on the discussions with the students; Williams (2006), who suggested using MT websites to improve students' electronic literacy; Steding (2009), whose work was concerned about preventing MT-based cheating and Niño (2009) proposing "good practices" and "bad practices" for MT use in LF class (p. 247-248).

Although at least one study (GASPARI; SOMERS, 2007) discusses the need for discouraging students from using MT for single word-lookup, the majority of studies that problematize the use of MT by students are concerned with the translation of longer texts and the belief that this is a form of cheating in FL class (CASE, 2015). Rather than looking only at the possible misuses of this relatively new electronic tool, however, we may wish to examine it further for its potentially positive applications in the study of foreign languages (WILLIAMS, 2006, p. 566-567).

Most studies in this field work with MT through two types of activities: post-editing and contrastive analysis. Post-editing exercises involve translating a text into the target language using MT and using one's skills in the target language to "correct" the "errors" made by the computer (BELAM, 2002; GROVES; MUNDT, 2015; KLIFFER, 2005;

NIÑO, 2008; SOMERS, 2003; ZANETTIN, 2009). Contrastive analysis involves translating from the target language to the students' native language, so that students can see the kinds of errors are produced in order to highlight differences in language structure, idioms, and collocations (ANDERSON, 1995; SOMERS, 2001, 2003). Most studies have focused on advanced learners or translators in training, (BELAM, 2002; NIÑO, 2008; O'BRIEN, 2002); however, there are some researchers who argue or investigate their use with beginners (CORNESS, 1985; GARCÍA (2010).

Garcia and Pena (2011) claim that MT helped their beginner-level students identifying MT as a type of scaffolding that together with the other digital tools and online activities could "support students in generating authentic language while interacting and collaborating in an enjoyable learning environment, with technology as the facilitator and stimulator of communication" (PENA, 2011, p. 66).

Another author that supports using MT as an advantage for students is Williams (2006), who suggests that they "force students to think about language as a communication tool, not as a set of decontextualized vocabulary words or phrases" (p. 574). In this sense, MT is not in itself "bad," of course, and there is an educational place for it in the classroom according to Case (2015), but many language instructors probably will encounter it as an uninvited guest.

3 Reading comprehension and a proposal for using MT in ESP classes

When it comes to the concept of reading comprehension, we need to discuss reading models. The interactive model described by the seminal work of Rumelhart, (1985) proposes an integration of the bottom-up processing (GOUGH, 1972), which understands reading from a linear sequence from decoding letters to sounds, words, sentences, and finally to meaning, and top-down processing (GOODMAN, 1967, 1970), in which the reader uses his prior knowledge to interpret the text and create hypothesis in order to understand it. From the interactive perspective, comprehension is not a final product, but a process that is developed along the reading according to the strategies and resources that the reader uses to attribute meaning to the text. The integration of both models (bottom-up and top-down) is defended by a number of authors based on the idea that comprehension depend on both, the information that is in the mind of the reader and what is printed in the text. Therefore,

reading is a dynamic process of meaning construction. Proficient reading is defined by Perfetti, Landi and Oakhill (2008), according to two components: word recognition and textual comprehension. It is assumed that comprehension cannot be achieved without the efficiency of the most basic processes involved in word recognition. Thus, understanding how reading comprehension occurs requires the study of the variables involved in word identification.

According to Perfetti (1985, 1999); Perfetti and Hart (2001), the limited capacity of working memory (WM) makes reading difficult when several processes that require attention need to be activated simultaneously. Based on this assumption, less proficient readers first struggle with the lowest elements in the hierarchy, which are language spelling rules and lexical knowledge, and then they move to the higher elements, which are syntactic and semantic knowledge. Although it is a useful strategy in the early stages of reading development, contextual exploration is just a stage and should not be the only support for compensating for vocabulary lacking.

During reading, the activation of prior knowledge in memory is essential for the construction of meanings, which may occur implicitly or explicitly through inferencing (DELL'ISOLA, 2001). In other words, meaning is produced as a result from the recovery of knowledge and values that are activated through various cognitive strategies, among which the production of inferences is fundamental.

The definition of inference is explained by Koch (1997) as “what is used to establish a non-explicit relationship in the text, between two elements of the text. The inferences arise from need and from the reader’s world knowledge” (KOCH, 1997, p.70 translated by the author). The concept of inference varies according to different authors. However, it is a consensus among authors that inferences fill in the gaps in the text, since the text itself does not comprise all the necessary information for the reader. Therefore, comprehension issues may result from this incompleteness or lack of knowledge, since miscomprehension may occur depending on the information that has been activated.

Nuttall (1996, p. 75) stated that “to infer the reader must have sufficient clues. Lexical inference will not help readers if all or most of the words are unknown. If, moreover, the context does not offer sufficient clues, inference becomes impossible.” As a consequence, less proficient readers in FL may be blocked in terms of bottom-up processing, which

will make it difficult to access prior knowledge in order to fill in the text gaps. Thus, the use of MT can be beneficial for beginner learners of FL, providing a general idea of the text so that the reader will be able to raise hypotheses about the text.

Another important aspect pointed by Grabe (1991) is that L1 readers usually have a wide vocabulary before they begin to read, while FL readers generally have a restricted vocabulary added to less experiences in the target language. The author argues that, although the reader has a good master of syntax in the FL, he is unlikely to be familiar with pragmatic and cultural knowledge, which are related to social interaction that is common for native speakers and it can hinder the perception of these aspects in the texts.

Due to the complexity involved in reading comprehension, there are many strategies that can be used for reading successfully. Strategies are behaviors that are consciously selected to facilitate understanding (NORDIN; RASHID; ZUBIR; SADJIRIN, 2013). For example, readers may decide how much time to spend looking at a word, whether to reread a section or to skip a section. They must decide when to summarize, question the text, or make predictions and in order to do so, readers depend on their executive control abilities (ARRINGTON; KULESZ; FRANCIS; FLETCHER; BARNES, 2014; CARTWRIGHT, 2012).

However, reading strategies are not only conscious and they can be divided into cognitive or metacognitive (KATO, 2007). They work as support to construct the textual coherence through the relations established between the elements of the text, such as syntactic segmentation strategies, and anaphoric retrieval. Proficient readers tend to use strategies more automatically, but when some new aspect arises interrupting the comprehension process, it makes the reader act consciously, slowing down his reading process in a reflected or metacognitive way.

These strategies function as fault detection mechanisms and result from increased processing capacity effort. Perception of reading failure is a part of comprehension monitoring, as the reader needs to know what to do when the failures occur, and this is where strategic decisions must be made. Furthermore, it has been postulated that good readers are more metacognitively aware of their own strategies than less proficient readers, as they tend to monitor comprehension better, being more aware of the characteristics of the text and the strategies they use while reading (NUTTALL, 1996).

There are several different types of reading strategies that are not going to be explored in this paper because it is not the main point. In summary, reading strategies play a special role in both NL and FL reading, as they are cognitive mechanisms for comprehension and therefore can be taught or develop language awareness, especially in reading.

One of the goals of ESP in Brazil, in the HEI context, is to assure that students will be able to read and comprehend academic texts in English as a foreign language. This paper proposes the use of MT in ESP courses for reading academic texts in EFL. Based on the studies cited in this paper it is possible to bring these practices into the reality of ESP in Brazil and adapt the activities suggested as well as design new possibilities.

Another relevant aspect of ESP courses is that dictionary use is an example of a conscious reading strategy for solving a lexical difficulty. From the same perspective, MT can be a support reading strategy. Riess (2015), in her PhD dissertation on reading strategies and the use of Google translator, discusses the use of MT as a reading strategy. The author claims that:

The idea is not to exclude the tool from the class, on the contrary, it is to include it and point out to failures and strengths of translation. We suggest the use of Google translate as a strategy that benefits reading comprehension, because the reader can search for translation to what is unknown, at the various levels- from the lexicon to the sentence till the whole text. (RIESS, 2015, p.104)

The idea is to include MT in class by pointing out the linguistic items the translation has either failed or succeeded. In this sense, it is suggested that using Google Translate is a strategy that benefits reading comprehension, since translation can be used at the lexical, sentence or text level, depending on the reader's proficiency. Riess mentions authors such as Perfetti and Hart (2001) and Scaramucci (1997), based on the idea that by increasing vocabulary, reading can flow better, because words are better understood, which makes comprehension occur. Also, in her study, Riess (2015) found that students prefer translating words more than the whole text. However, the number of participants may not be statistically enough to conclude such a behavior. In this sense, the use of Google translate would not be that different from the dictionary. However, participants from Eastern languages (mostly Arabians) demonstrated to

translate sentences more than words. In the verbal protocols they say word order is one of the most difficult for them.

In this paper, we propose working with MT in ESP courses that focus on academic reading because, in Brazil, using dictionary is a common support strategy in these courses, since the majority of students show low level proficiency and need this resource for comprehension. Thus, MT can be an important tool as a reading strategy. Therefore, meanings can be searched through online dictionaries, but also through Google Translate, which is proved to be widely explored among students. Therefore, ESP teachers can use it for pre-editing and postediting activities using MT in different levels of search, such as word meaning, sentences or even entire texts. Abstracts can be used as an example of text, being short texts, which summarize scientific papers, these texts are suitable for academic reading classes. It is important to emphasize that scientific language can be quite predictable, being more direct by using objective language and avoiding language aspects which normally appear in literary texts and usually result in mistakes for MT such as metaphors and other figures of speech.

In this article we suggest teachers three tasks to be used in ESP lessons. They are theoretically founded in the subjects already described previously, they are 1) Translating and discussing, 2) Reading and translating, 3) Checking mistakes. In the first case an abstract translated from English to the student's native language could be read and discussed in class focusing on the linguistic issues. The teacher, then, counts on the student's linguistic awareness, because discussions will probably be raised by the student's view. The second activity is reading an abstract in the FL using strategies and then have the Google translation to check the ideas. In such a circumstance monitoring reading is at stake because students have to compare their comprehension either by using strategies or by the language translated by the machine. The third suggestion we give has to do with the efficiency of machine translation. This is because discussing the possible mistakes made by MT is a different way of teaching grammar rules and structures. In addition to these linguistic items, teachers can also explore vocabulary. The role of the teacher is more active in this case, because it is him/her who points out where idiosyncrasies are. It is different from using parallel bilingual corpora, for example, because in this situation the student counts more on his/ her intuition to infer meaning, whereas with MT the teacher is, to a certain

extent, the mediator of knowledge. In fact, this has to do with explicit teaching rather than implicit, because teachers will locate where errors are and display them in order to call student's attention.

While using Google translate the student's attention is focused on the translated text, thus, by using MT for formal instructions, teachers can provide the students with a chance to pay attention to the original text, which is the purpose of ESP courses. Additionally, abstracts are usually short, and the general language corpus are very similar, which creates an opportunity to work with scientific language, and prepare students for future academic writings. This view agrees with the idea of integrated language and content language instruction already discussed by those involved in the Science without borders program described previously (SARMENTO TESSLER; BAUMVOL, 2015).

Final remarks

Technology has been used in education all over the world in different types of subjects and there are several online tools available for pedagogical practices in language learning. Among various resources for foreign language studies through technology, this study demonstrates that MT systems have been improved over the last decades and that new methodologies are being employed on a linguistic and interdisciplinary basis. Research show that Google translate is the most accessed free online MT tool by students. Google translate is processed by a hybrid system that combines rule-based and corpus-based systems, in quite coherent texts.

Reading comprehension requires lexical knowledge, consequently, low proficient readers in a foreign language usually struggle to comprehend FL texts due to lack of vocabulary and language structure. ESP courses in universities in Brazil are generally focused on reading skill development. Assuming that English is a global language in science, undergraduate and graduate students should be able to read in English in order to access international research.

Based on a number of studies conducted by researchers from different parts of the world, MT can be used in FL classes for pedagogical purposes. There are different approaches and activities that can be carried out with learners, such as post-editing and analytical tasks that have been proved to help students to raise language awareness and knowledge.

The methodology applied in ESP courses involve not only the integration of content (the specific field) as well as teaching reading strategies, which includes dictionary use. Therefore, this paper proposes using MT as a reading strategy and as a pedagogical tool for teaching grammar, vocabulary and develop language awareness.

Finally, it is important to emphasize that further studies need to be conducted, especially in relation to ESP in academic settings, since most of the studies are regarded to general EF language courses. Furthermore, research should be designed in order to develop methodologies that can quantify the comprehension degrees of an automatically translated text and the cognitive aspects involved in this process, as well as investigations on the effectiveness of using Google Translator as a pedagogical instrument. We believe a combined quantitative and qualitative study can show more concrete outcomes to both experience and intuition on the use of MT for fruitful pedagogical practices.

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Authors' Contributions

Débora Ache Borsatti is a PhD student at the University of Santa Cruz do Sul (UNISC). The author has been researching about the use of machine translation in ESP courses, focusing on reading in English for Academic Purposes. This paper was written as an assignment for the course “Second Language Acquisition”, lectured by author 2.

Adriana Blanco Riess is a co-author in the paper. As an assistant professor at UNISC, Adriana read, reviewed, and added important contributions for the proposed discussion.

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